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SHORTER ARTICLES AND CORRESPONDENCE

IS THERE A SELECTIVE ELIMINATION OF OVARIES IN THE FRUITING OF THE LEGUMINOSÆ?

DURING the past few years I have had occasion to have counted the number of ovules formed per pod in series of many thousands of pods of various species of Leguminosæ. While engaged at this work a side problem of considerable interest presented itself. Since time to follow this up has not been forthcoming for a couple of years, I will publish my data and suggestions for the benefit of any unoccupied botanist.

It is evident that the distribution of ovules, as seen in series of mature pods, does not necessarily represent that of the ovules in the newly formed ovaries. It is possible that the distribution of ovules per ovary in the flower buds may have been modified as the fruits matured by a selective elimination of certain classes of pods. This selective elimination might modify mean or variability or both. One such case is very probably to be found in ovaries with but a single ovule in species normally producing several. If the single ovule be fertilized it may develop into a seed or not, according to various circumstances; but if it fail to develop, the pod will, in most cases at least, fall from the plant. Whether the same factor is at work in the case of ovule classes of a higher order can only be determined by special investigation, but it seems quite possible that such an influence might affect very materially the constants of mature as compared with newly formed ovaries.

In the spring of 1907 I attempted to get some light on this question by the collection of material at different times from individual red bud trees, *Cercis Canadensis*, growing in the North American Tract of the Missouri Botanical Garden.

The flowers of Cercis are produced in an umbel-like cluster from the old wood. These clusters are composed of from two to seventeen flowers. Many of the inflorescences produce only one to four fruits. The per cent. of flowers which mature fruits varies widely from year to year and from tree to tree, but it is evident that there is a very heavy elimination of ovaries. The question to be answered is: Have the eliminated ovaries a different mean or variability, or both, for the number of ovules which they produce than those which develop into mature fruits?

Cercis seems to be a form well adapted to an investigation of this question. The ovaries can be quickly dissected out of the flowers which have been dropped into alcohol for preservation. Absolute alcohol renders the walls sufficiently clear that by the aid of the light from a properly adjusted mirror of the dissecting microscope the ovules may be counted very easily. Clove oil may be used as a clearing agent, but it soon renders the ovules as well as the walls transparent, and great watchfulness is required in the countings.

On March 28 a series of one hundred inflorescences was taken from each of three trees and dropped into alcohol for future study. This was at a time when most of the flowers were open, but when none had fallen from the trees. The whole inflorescence was taken because (*a*) it was desirable to avoid any possibility of an unconscious selection of flowers in gathering, and (*b*) because it seemed desirable to determine whether the position of an ovary on the inflorescence might exert any influence upon the number of ovules produced.

On April 3 a second lot of material was collected, but in an entirely different manner. Many of the blossoms were ready to fall. The trees were shaken, not too violently, so as to secure the flowers which were ready to drop, but not to dislodge those with ovaries which might continue to develop. In preserving this material all the flowers belonging to inflorescences which had fallen were discarded, since it seemed possible that some of them might have been brushed off by twigs rubbing together. All the flowers were open, and, if their very frayed condition may be taken as a criterion, most of them had been visited by insects. The ovaries were dissected out of the flowers at once and dropped into absolute alcohol. Unfortunately the second collection from Tree II was lost.

On April 6 a third collection was made in the same manner as the second.

My intention had been to collect the matured pods of these trees in the fall for comparison with the ovaries taken in earlier stages of development, but, unfortunately, the severe frosts which followed the early opening of spring in St. Louis, in 1907, killed most of the Cercis fruits and precluded the carrying out of this part of the work.

In taking up the counting of the ovules per pod it was found that the alcohol had rendered the material so brittle that it was out of the question to keep the flowers in serial order from the base of the inflorescence, and consequently all attempt at a determination of this point was abandoned for the first collection. As a matter of fact the flowers are so closely grouped in the inflorescence of the red bud that the determination of their sequence would not be easy even in freshly gathered clusters. *A priori,* one would suppose that in an inflorescence so shortened as this, position on the axis would have little influence upon the character of the ovaries. But of course this point should be investigated, for if there is a sensible correlation between position on the inflorescence axis and number of ovules, and between the position of an ovary on the inflorescence and its chances of growing into a mature fruit, this might introduce a serious difficulty into the comparison of eliminated and matured ovaries, in consequence of those of certain types being eliminated merely because of their position on the inflorescence.

Table I

Frequency of Numbers of Ovules per Ovary in Various Collections of Cercis

Tree.	0	1	2	3	4	5	6	7	8	9	10	?	Totals.
I.—Lot 1					3	1	49	279	476	76	4	11	899
I.—Lot 2				2	1	2	8	113	219	39	3	4	391
I.—Lot 3						1	28	113	179	32	3	2	358
II.—Lot 1	1	1	5	32	177	327	431	100	4			10	1088
II.—Lot 3				2	58	126	112	21	2			1	322
III.—Lot 1			10	23	198	341	179	11				14	776
III.—Lot 2			4	8	85	177	63	5				1	343
III.—Lot 3			2	10	81	170	77	6	1			1	348

The numbers of ovules per ovary for the several series of material are seriated in Table I. In a very small percentage of the cases it was impossible for one reason or another to determine the number of ovules. These cases are placed in the ? column; in calculations they have not been considered, N being reduced by their number. I have no reason to think that these ovaries are in any way different from the others, and so they might have been discarded without comment, but in material of this kind it is best to account for every individual. Perhaps the single entry in the 0 column is due to one of the ovaries being too young.

The constants from Table I are given in Table II.

Regarding first the means, we note that there is no constant difference between those of the different collections. This is true without considering the probable errors, which at once take away any opportunity for theorizing on these points. Inspection shows the same conclusion to be necessary concerning both absolute and relative variabilities.

TABLE II

CONSTANTS FOR OVULES PER OVARY IN VARIOUS COLLECTIONS OF CERCIS

Collections.	Total Ovaries.	Mean and Probable Error.	Standard Deviation and Probable Error.	Coefficient of Variation.
Tree I. Lot 1	888	7.6531±.0172	.7631±.0122	9.9718
Tree I. Lot 2	387	7.7312±.0276	.8070±.0195	10.4386
Tree I. Lot 3	356	7.6235±.0285	.7995±.0202	10.4875
Tree II. Lot 1	1077	5.3556±.0207	1.0091±.0146	18.8429
Tree II. Lot 3	321	5.3052±.0331	.8826±.0234	16.6375
Tree III. Lot 1	762	4.9041±.0216	.8844±.0152	18.0339
Tree III. Lot 2	342	4.8830±.0299	.8224±.0212	16.8426
Tree III. Lot 3	347	4.9567±.0306	.8459±.0236	17.0677

So far as this series of data goes, therefore, we have no reason to think there is any selection in the elimination of the ovaries which do not develop into mature fruits. Most unfortunately the mature fruits are not available for comparison. This renders it necessary to draw the comparisons not between the constants for all the ovaries formed and the fruits maturing, but between the constants for the original population of ovaries and those for the fallen flowers. While not so satisfactory as the former method, the latter is quite justified in the present case, since the second collection represented the first of the ovaries to be eliminated from the tree and the third was taken from the main bulk of those which were to fall. During the last two years I have not succeeded in getting suitable data for the number of the ovules in trustworthy samples of ovaries formed and ovaries maturing in either this or other species of Leguminosæ. In our present dearth of quantitative data concerning selective elimination, this seems a good line to follow far enough to get conclusive positive or negative results. Perhaps some other botanist can collect adequate masses of data.

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